Towards Open Corpus Adaptive E-learning Systems on the Web

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Abstract. Development of conceptual knowledge is an important part of education. In individualized instruction this aim can be facilitated by concept maps interconnected with learning materials. Traditional adaptive web-based e-learning systems use a closed and static corpus, which is predefined in the design time. But there is plenty of learning resources publicly available on the Web, which provide a huge potential for learners. Obviously, it would be very useful to have an opportunity to choose for a particular context a suitable concept map that could dynamically access selected learning repositories and enable an intuitive navigation in both the concept and document layers, as well as between them. We have attempted to develop a solution that is based on the principles of open corpus adaptive educational hypermedia and at the same time can be part of a personal learning environment. The outcomes show that this may be a promising approach, but its usefulness is highly dependent on the usability and flexibility of the e-learning application.

Keywords: Adaptive E-learning Systems, Open Corpus Adaptive Educational Hypermedia, Concept Map, Ontology, Learning Repository, Reusability, Personal Learning Environment.

1 Introduction

Individualized instruction is a crucial requirement of the modern era and web-based learning provides many approaches how to address this big challenge. From the pedagogical perspective one of the key learning theories is cognitivism [1], which aims to develop internal cognitive structure that strengthens synapses in the brain. One way how to technically support this approach is by means of interactive concept maps [2], which are graphical tools for organizing knowledge that represent it in graphs, showing the relationships among concepts. Concept mapping has been shown to help in learning, creating new knowledge, writing, and assessment. A concept map enables active acquisition of knowledge and can be also used as a network for navigation, allowing for discovery learning [3], which is a technique of inquiry-based instruction, based on the principles of constructivism. It is also a method of instruction through which students interact with their environment by exploring and manipulating objects.
Context exploration can be supported by concept based navigation [4], when the learner can easily access a wide spectrum of the relevant concepts. This fosters an inductive way of learning relationships among concepts. Navigation in the semantic space can start from an occurrence of a concept in a learning material. Then the concept map can be accessed, showing correlated concepts as well as materials related to the concept, explaining its meaning. This concept map is an example of opportunities that web instruction provides to enhance learning, because information can be accessed in different ways, choosing always the preferred perspective. Students and teachers appreciate in the web environment what they cannot find in traditional classroom [5]. But going beyond the “no significant difference phenomenon” requires more attention for innovative approaches enabled by online instruction.

The positive outcomes from this approach lead us towards ideas about how to overcome its limitations related to the system closeness and how to generalize it. We see a challenge in exploitation of the huge amount of publicly available resources on the Web and their orchestration towards an open and flexible learning environment providing a new quality of experience. So instead of the traditional adaptive e-learning systems with a closed and static corpus predefined in the design time, the teacher or the learner could have an opportunity to choose an appropriate concept map in the form of an ontology and dynamically interconnect it with selected learning repositories in order to enable a flexible selection of learning resources and navigation on both concept and document layers, as well as between them. This kind of reusability and interoperability is also a main aim of open corpus adaptive educational hypermedia [6]. Here we aimed to integrate this approach with the personal learning environment interface, which is becoming popular.

In the next paragraphs we first introduce a theoretical background for this work. Then our conceptual approach is explained. In the following paragraph we describe the system architecture and its implementation. Afterwards the evaluation outcomes are presented. Finally we conclude the paper, summarizing its main results.

2 Theoretical Background

An adaptive system can react to certain circumstances and adapt accordingly. The process of adaptation is typically based on users’ goals and preferences. These and other relevant properties of the user are stored in a user model, which enables the system to tailor its reaction accordingly [7]. In the context of e-learning, adaptive systems are more specialized and focus on the adaptation of learning content and navigation. An adaptive system intervenes at three stages during the process of adaptation – it controls the process of collecting data about the user, the process of building up the user model (user modeling), and during the adaptation process [7]. But traditional adaptive hypermedia systems take into account only a limited set of documents and relations between them that have been chosen at design time, i.e. closed corpus. Therefore a natural challenge is to exploit the huge potential of the available resources on the Web and to enable dynamic updates of the materials considered. An open corpus adaptive hypermedia system has been defined as “an adaptive hypermedia system which operates on an open corpus of documents, e.g., a